Canadian petrochemical plants blamed for gender imbalance

Residents of Canada's Aamjiwnaang reserve have long blamed their health problems on the petrochemical plants that crowd the landscape. But scant evidence supported their claims—until now. Paul Webster reports on a study of newborn gender imbalances that has reopened the debate.

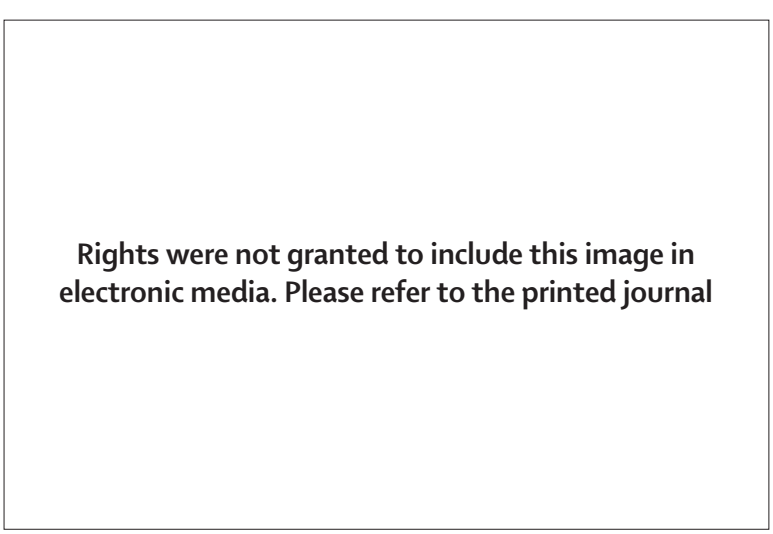
"You get strange smells here", Ada Lockridge says as she climbs out of her jeep and heads for her great grandfather's grave in the Aamjiwnaang cemetery, a once-quiet hillock now surrounded by humming oil and chemical plants. Facing a line of fire-spitting refinery smokestacks, Lockridge gives the air a slightly theatrical sniff. "Maybe it's naphtha today", she pronounces.

Lockridge is a volunteer environmental monitor on the Aamjiwnaang native reserve, once part of the Chippewa's central North American empire. The reserve, which is on the Canadian side of the Canada–USA border about an hour's drive from Detroit, directly faces Canada's largest concentration of petrochemical plants. About 40% of Canada's synthetic rubber, polyvinyl chloride and plastics is produced here. The area is also home to one of Canada's largest hazardous-waste dumps. Few tourists care to stop in this now-blighted place. In recent months, however, health researchers and news reporters from across Canada, the USA, and Europe have streamed into Aamjiwnaang.

The spotlight settled here last October, when the US journal *Environmental Health Perspectives* published a study indicating significantly fewer males than females were born over the last decade among the 850 aboriginals living on the reserve, where people have long complained about exposure to toxic pollutants.

Lockridge, who co-authored the article, says she's had little peace since the results were released: "The reporters and professors all want to take my 'toxic tour'," she says with a slightly mischievous smile. "It's just ruined all my normal routines."

Lockridge's tour reveals a Dickensian juxtaposition of massive petrochemical facilities and rows of modest aboriginal family homes. After a stop at the Leaky Tank Truck Stop, there's a hike through an abandoned, unsecured open-air chemical dump, and a visit to a recently closed kindergarten located just a stone's throw from a massive chemical plant. The new kindergarten seems better situated, although the omnipresent chemical complexes still tower nearby.



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Along the route, Lockridge flips open a diary recording a monthly average of five-to-ten local chemical release "incidents". Most of these events remain unexplained by plant managers, Lockridge complains. Government regulators have issued many warnings and imposed numerous stiff penalties in recent years, but the troubles at the plants continue.

"Every few months we smell something really nauseating, black clouds fill the sky, the sirens go off, and we're all ordered indoors", Lockridge says.

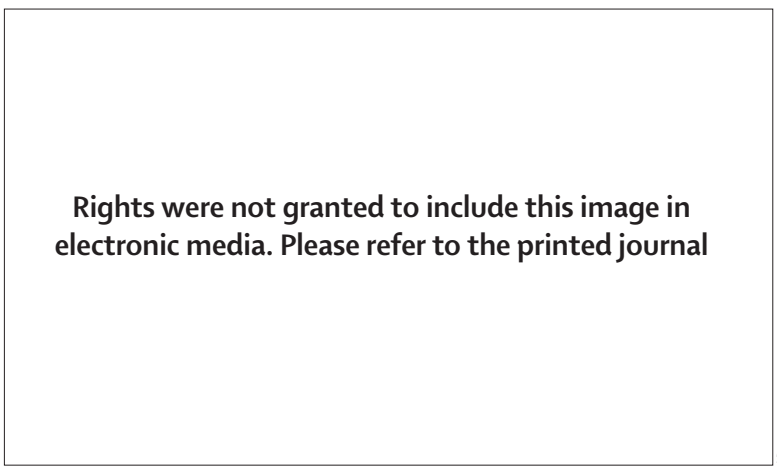
The oil refineries and chemical plants date back more than a century to when oil was discovered near the Aamjiwnaang traditional lands, which border the St Clair river connecting the Upper and Lower Great Lakes to form the world's largest freshwater repository. By the 1960s, the small Ontario city of Sarnia had sprouted on land bargained-off by Lockridge's ancestors, and the area around the reserve had come to be known as Canada's "Chemical Valley". These days, numerous multinational oil and chemical giants operate massive refineries along the edges of the reserve.

Serious health concerns first surfaced in the 1970s, when investigators called attention to asbestos exposures among oil workers in the region. In 1985, chemicals dumped into the St Clair River coagulated into a massive underwater slick. The "Sarnia Blob", as it was dubbed, was found to contain arsenic, copper, cadmium, chromium, iron, lead, mercury, nickel, zinc, polychlorinated biphenyls (PCBs), hexachlorobenzene, phosphorus, chromium, iron, lead, mercury, and manganese, oil, grease and a cocktail of at least 30 toxic compounds known as polyaromatic hydrocarbons.

Although water quality in the region is notoriously dubious, it's the

refineries' atmospheric emissions that attract most attention these days. A 2004 study noted extremely high male hospitalisation for cerebral palsy, possibly associated with mercury exposures in the area. And a review by Toronto's *Globe and Mail* newspaper of census data gathered in 2001 found that communities downwind from the refineries have a skewed birthrate, though not as pronounced as on the reserve.

But despite the history of health worries and massive pollution, no broad-based epidemiological study has ever been commissioned to examine possible toxicological impacts on the 130 000 people living in the area.



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Aamjiwnaang reserve lies near the largest collection of petrochemical plants in Canada

The decision by Lockridge and colleagues to investigate gender skewing on the reserve resulted from a chance encounter. When someone mentioned that girls' baseball teams outnumber boys' teams on the reserve during a discussion at the Ontario government's Occupational Health Clinic for Ontario Workers, Constanze MacKenzie, a fourth year University of Ottawa medical intern, took note.

As a biology graduate, MacKenzie had spent years studying the gender-bending impacts of phenols and other chemicals on Ontario turtles and fish. She was well aware that studies of fish, birds and reptiles in the area around the reserve showed striking evidence of reproductive abnormalities including numerous intersex births, hormone production interference, thyroid function disruption, birth rate reduction, penis length reduction, and embryonic mortality. She also knew that many researchers consider these findings in wildlife highly relevant to humans. "When we have so much evidence from so many species showing reproductive disorders you have to ask, are humans really so different?", says MacKenzie.

Working with Lockridge and Margaret Keith, a research coordinator at the Occupational Health and Safety Clinic, as well as with external help from Theo Colborne, a leading Washington, DC-based endocrine disruption investigator, Mackenzie set out to check whether concerns on the reserve about gender skewing were simply a misperception. A review of the reserve's birth records between 1984 and 1993 showed no aberration. But between 1994 and 1998 the number of male births dipped noticeably. And during 1999–2003 they dropped even more. Of 132 births in that period, only 46 were males. Normally about 105 boys are born for every 100 girls. "We have to approach these findings with caution because the sample size is small", Mackenzie stresses. "Even so, there's only a 1% chance the trend we found is a fluke."

But the link between pollutants and reproductive effects remains speculative. Although researchers have established reproductive problems in people exposed to very high doses of gender-bending toxins—such as the Italian city of Seveso, where a dioxin-producing pesticide plant exploded in 1996—no study has firmly linked these outcomes to routine environmental exposures.

Arnold Schecter, a University of Texas environmental toxicologist who has investigated human exposure to several environmental toxins, praises the Aamjiwnaang study as a "well thought-out" investigation. But the study hasn't persuaded him that the case for human gender-bending from environmental exposures to endocrine disrupters is growing.

Jake Ryan, a senior researcher at Health Canada, Canada's federal health agency, agrees. He has probed gender-skewing among pesticide workers in Russia and says the Aamjiwnaang study requires follow-up: "I would like to see whether these results can be repeated in the non-native population living near the reserve", says Ryan.

At least for the reserve communities, things seem to be improving. Scott Munro, manager of the Sarnia-Lambton Environmental Association, an environmental group funded by several chemical companies has monitored local air emissions for decades. "People talk about pollution conditions that made them cry in the 1950s", says Munro. "It's much cleaner than it was." Even so, Munro acknowledges there are plenty of "fugitive emissions" from the plants. Many of these may not be recorded, nor their health effects well understood, he admits.

A full-scale health study of the sort recommended by Lockridge and Mackenzie is needed, he agrees. The only trouble with doing such a study, says Munro, is finding someone to pay for it.

Ada Lockridge says she's not holding her breath waiting for action. The Ontario and Canadian governments are still studying whether to even study the matter.

Paul Webster